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DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER

Bethesda, Maryland 20084-5000

THE ZOG/VINSON TECHNOLOGY DEMONSTRATION PROJECT: CV SHIPBOARD MANAGEMENT SUPPORT SYSTEM SPECIFICATIONS

by

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COMPUTATION, MATHEMATICS, AND LOGISTICS DEPARTMENT
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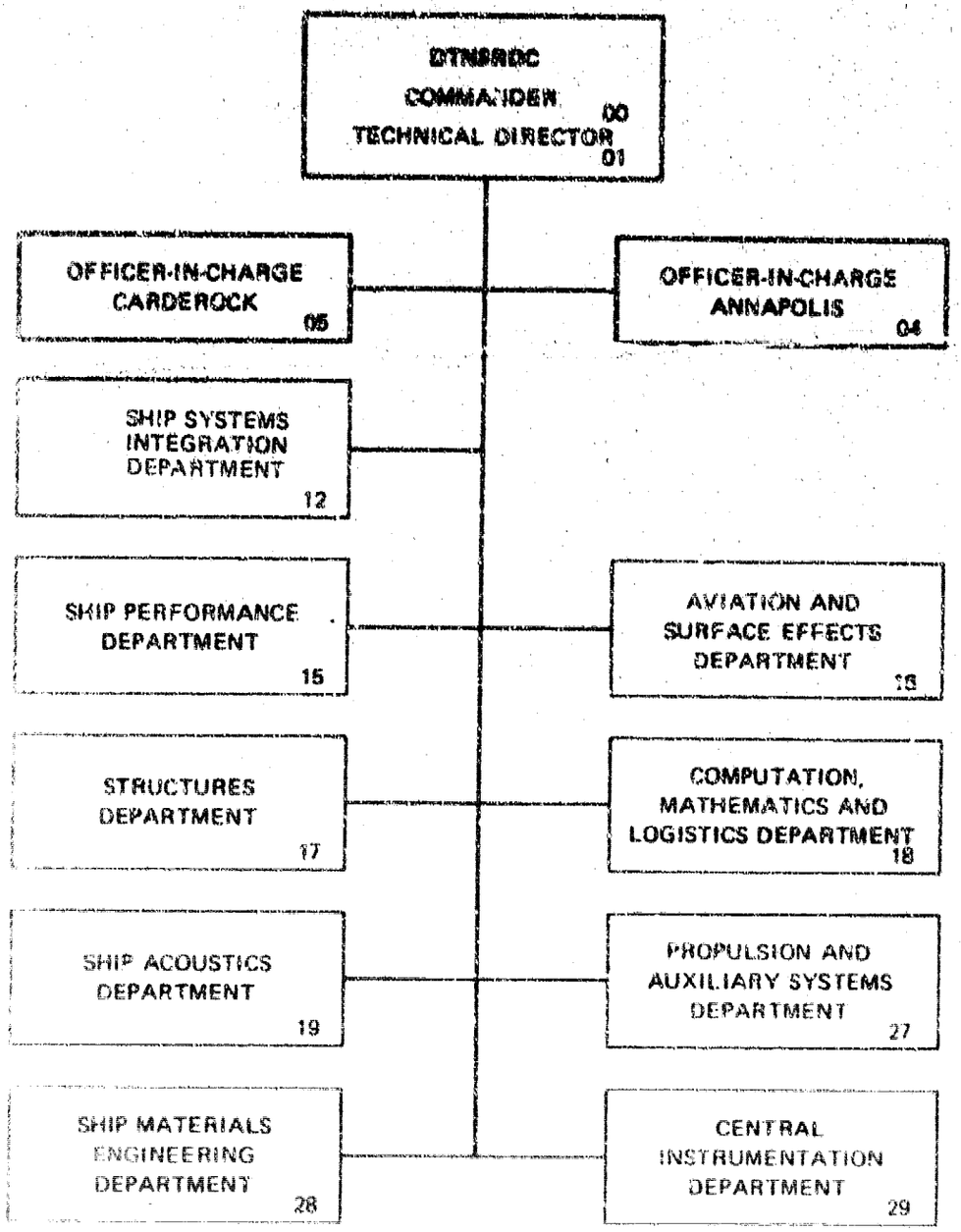

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The CV Shipboard Management Support (CVSMS) System is proposed to support management needs aboard aircraft carriers (CV). These needs include the advanced planning and scheduling of shipboard evolutions, status monitoring and coordination of task accomplishment, and the evaluation of progress and execution in comparison to stated objectives and standards. This report establishes specifications for the performance, design, development, and test requirements for the system in accordance with MIL-STD-490.

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LIST OF ABBREVIATIONS

CVSMS	Aircraft carrier, Shipboard Management Support System
DTNSRDC	David Taylor Naval Ship Reasearch and Development Center
IPS	Interprocess message communication
I/O	Input/Output
MTBF	Mean time between failures
P&E	Planning and estimating
SORM	Ships Organizational and Regulations Manual
VDT	Video Terminal Device

ABSTRACT

The CV Shipboard Management Support (CVSMS) system is proposed to support management needs aboard aircraft carriers (CV). These needs include the advanced planning and scheduling of shipboard evolutions, status monitoring and coordination of task accomplishment, and the evaluation of progress and execution in comparison to stated objectives and standards. This report establishes specifications for the performance, design, development, and test requirements for the system in accordance with MIL-STD-490.

ADMINISTRATIVE INFORMATION

The ZOG/VINSON Technology Demonstration Project was a joint effort performed by personnel from the USS CARL VINSON, Carnegie-Mellon University, Mellon Institute, the Navy Personnel Research and Development Center, and this Center. This report concludes the effort by supplying a functional system specification for procurement of an operational system which incorporates the concepts validated by the project. The format used is that described for a functional system specification in MIL-STD-490. This report was sponsored by the Office of Naval Research (ONR 270) under Program Element 62763N, Task Area RF63521805, Task 490-005, Work Unit 1826-008.

1. SCOPE

1.1 IDENTIFICATION

This specification establishes the performance, design, development, and test requirements for the CV Shipboard Management Support (CVSMS) system. The CVSMS system provides aircraft carrier (CV) shipboard managers with automated computer support to assist in planning, scheduling, coordinating, and evaluating the progress and effectiveness of shipboard activity in meeting operational objectives.

1.2 DOCUMENT OUTLINE

This specification is organized as follows. Section 2 contains a list of all U.S. Government and nongovernment documents referenced in this specification. Section 3 contains the requirements for the CVSMS system. Section 4 contains the quality-assurance provisions for the CVSMS system. Sections 5 and 6 are not applicable to this specification and are null.

The language used throughout this specification attempts to conform to the guidelines of Section 3.2.3 of MIL-STD-490. In particular, the word "shall" means that the specification expresses a provision that is binding. The words "should" and "may" mean that the specification expresses a provision which is nonmandatory. The word "will" is used to express a declaration of purpose on the part of the Government.

2. APPLICABLE DOCUMENTS

The following documents, of the exact issue shown, form a part of this specification to the extent specified herein. The name in brackets is the name used when the document is referenced in the text.

2.1 GOVERNMENT DOCUMENTS

2.1.1 Directives, Manuals, and Standards

[DOD 5200.28]	Security Regulations for Automatic Data Processing (ADP) Systems
[DOD 5200.28-M]	ADP Security Manual
[DOD 4120.17M]	SECNAVINST 5233.1
[MIL-STD-461]	Electromagnetic Interference Characteristics; Requirements for Equipment
[MIL-STD-490]	Specification Practices
[MIL-STD-483]	Configuration Management
[MIL-STD-1521A]	Technical Reviews and Audits

2.1.2 Reports

[ZOG-ER]	The ZOG/VINSON Technology Demonstration Project: System Evaluation On the USS CARL VINSON (NPRDC-1984)
[ZOG-CM]	The ZOG/VINSON Technology Demonstration Project: Configuration Management Report (DTNSRDC/TM-18-84/26)

2.2 NONGOVERNMENT DOCUMENTS

[CMU-CS-84-113]	Experience with the ZOG Human-Computer Interface System (Feb 1984)

[CMU-CS-84-127] ZOG and the USS CARL VINSON: Lessons in System Development (Mar 1984)

3. REQUIREMENTS

3.1 SYSTEM DEFINITION

3.1.1 Missions

The CV Shipboard Management Support System is an automated system which supports the ship's commanding officer (CO), executive officer (XO), and Department Heads in the management of shipboard activity. This includes the advanced planning and scheduling of shipboard evolutions, status monitoring and coordination of task accomplishment, and the evaluation of progress and execution in comparison to stated objectives and standards.
Supported capabilities include:

- Techniques for rapidly and easily producing, extending, and modifying the electronic version of the statements of responsibilities that a unit must carry out to maintain combat readiness; also, who is responsible for carrying them out.
- A dynamic, interactive, and easy to use planning and control system to track the accomplishment of assigned responsibilities.
- Techniques for streamlining the flow of tasking, status, and coordination of information between departments, as well as up and down the chain of command.
- Provision for instantaneous, easy access to policy and procedural information at the decision maker's desk, thereby permitting real-time resolution of questions of responsibility and authority.
- Provision for a menu-structured information base stating the overall responsibilities of performing the ship's mission. Incorporate subresponsibilities into that structure in a way that accomplishes them and directly evaluates the ship's performance. This provides a measure of the ship's readiness, as reported in performance reports.
- The ability to rapidly produce and distribute specific tasking, milestones, and location and responsibility information for shipboard

evolutions based on generic responsibility and task descriptions. A specific example is the ability to produce and coordinate the daily "green sheet."

- A data base of generic task descriptions in electronic form with the ability to rapidly and easily insert dates, locations, and performers. Revisions of dates and time must be easily accommodated.

3.1.2 General Description

This management system should be available at the desk of the user--in this case, the CO, XO, and Department Heads, as well as at various work centers throughout the ship. These system users must be connected so that the exchange and sharing of electronic data is instantaneous. The user interface through which the user controls and uses the automated support system must support all the types of tasks desired by the shipboard manager. It must be easy to learn and to use.

The CVSMS system provides the hardware and interface software to make possible the performance of the above capabilities. This automated system includes:

- Rapid, accurate access to large bodies of information for the perusal or accumulation of information.
- An ability to start automatic processes to operate on these large bodies of data that are hosted in the interface for data accumulation.
- An ability to invoke applications by a standard user interface.
- An ability to shift into a system-building mode whereby the user can add information or processes (possibly via computer programs) and extend his interface so that a less-skilled system user can use the newly added data or processes to full advantage.
- The concept of a redundant information base to insure incremental and real-time back up of all information and access to secondary copies when primary copies are not available.
- Sufficient redundancy in software, and particularly in hardware, to allow nearly 100% availability of information from the system.

The architectural, operational, performance, capacity, and modification requirements for the CVSMS system are specified in detail later in Section 3.7. The specific requirements to be met by individual system components and

subcomponents are presented in the subsections subordinate to 3.7. These requirements were developed as part of the ONR-sponsored ZOG/VINSON Technology Demonstration Project, an exploratory development project which included operational prototype testing on the USS CARL VINSON during its first full deployment period in 1983. Table 1 shows the main system components of the CVSMS system and their breakdown into subcomponents.

TABLE 1 - BREAKDOWN OF CONFIGURATION ITEMS

Configuration Item	System Components	Major Subcomponents
Human-Computer Interaction Software	System	Initialization; Selection Processing; Action Processing; Utilities; Subnets and Reference Files
	Netserver	Network Interface
	Editors	Frame; Slot
	Agents	Agent Interface
	Statistics	Statistics Interface
Applications	Management	Planning and Evaluation; SORM
	Others	Electronic Mail; Programming Environment; Various Others
Operating System	Software	Operating System
Computer Hardware	Equipment	Distributed Network

3.1.3 System Diagrams

Figure 1 shows the relationships between major components of one example of the CVSMS concept (i.e., as in the Perq/ZOG system previously tested on the VINSON).

3.1.4 Interface Definition

The CVSMS system work stations must be interfaced to the onboard SNAP system to emulate existant SNAF system terminals for the exchange of information/data with that system.

3.1.5 Government-Furnished Property List

This section is not applicable to this specification.

3.1.6 Operational and Organizational Concepts

See Section 3.7 for this information.

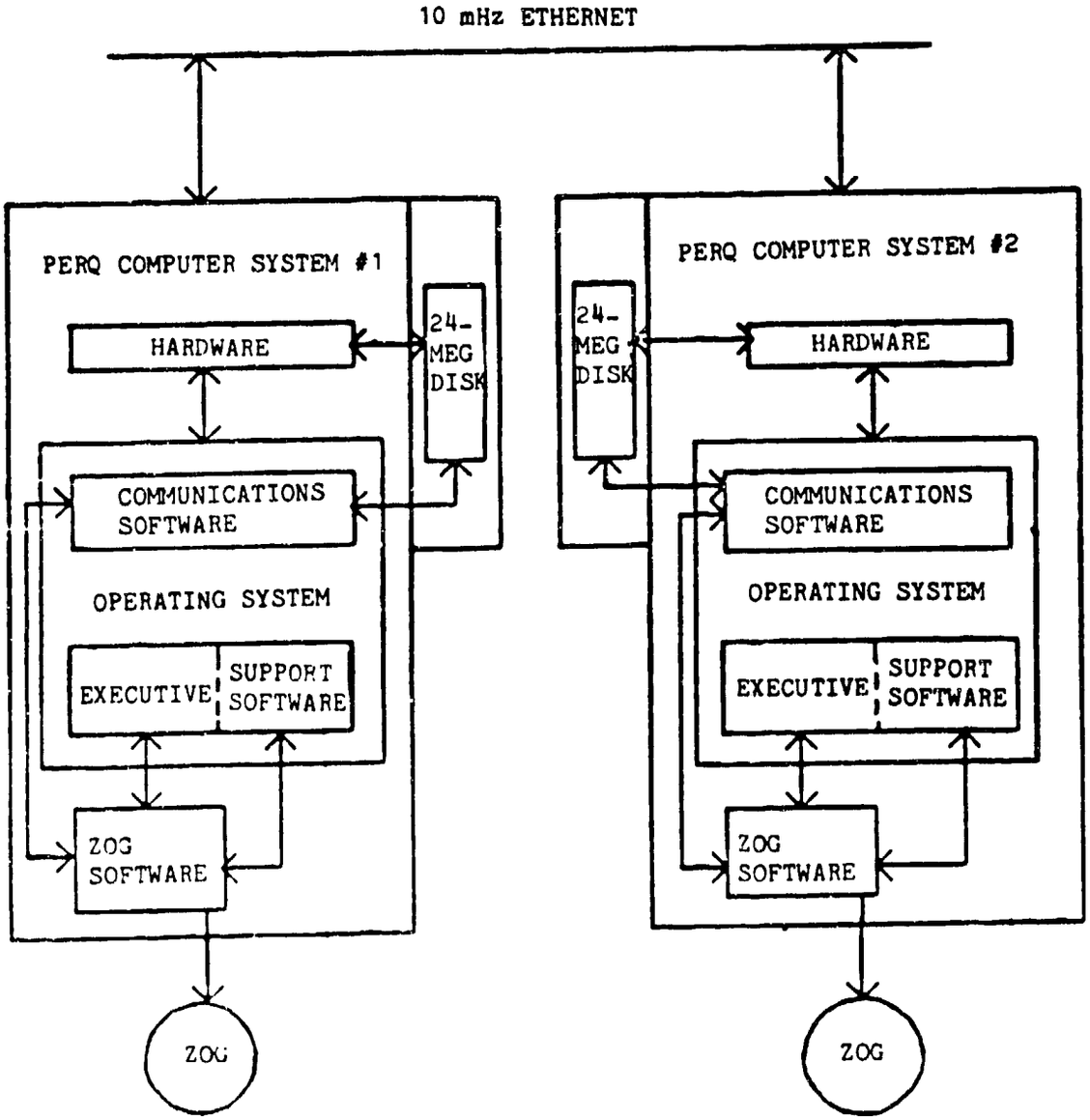

Figure 1 - ZOG System Software Relationships

3.2 CHARACTERISTICS

3.2.1 Performance Characteristics

The performance characteristics of the CVSMS system must support the required functionality as defined in Section 3.1, and further delineated in Section 3.7.

3.2.2 Physical Characteristics

The CVSMS system shall meet certain physical requirements imposed by the environment onboard ship. These requirements are:

- Weight. The target weight of the equipment is 100 lb per work station. Weight for the proposed configuration shall not exceed this target by more than 100%. Each separate unit must be light enough to be carried to the shipboard installation site from an above-decks location.
- Size. Each unit shall be small enough to pass through the normal ship ingress. The critical doorway or hatch dimensions are 28 in. by 60 in.
- Maintenance Access. The CVSMS system shall allow sufficient access to perform maintenance onboard ship.

3.2.3 Reliability

The contractor shall define in his Reliability Program Plan a parts reliability assurance program, including organizational responsibilities, to assure uniform part reliability. To the extent possible, the contractor shall use his standard policies, practices, and operating procedures to the extent that program control can be maintained.

3.2.4 Maintainability

Maintenance actions that are required on a periodic basis shall be identified by the contractor for each configuration item. A planned maintenance analysis shall be provided which lists the man-hours, materials, and procedures needed for each item at each maintenance period [time, rate, complexity (number of people/equipment variety), and indices (costs per operating time, overhaul man-hours)]. The contractor shall also provide the total maintenance required for each CVSMS configuration, expressed as man-hours per year. Corrective maintenance procedures shall be provided to support the capabilities of the system. Both planned and corrective maintenance actions

must be documented in the contractor's written technical manuals with sufficient detail and accuracy to permit effective performance at the shipboard organizational level of maintenance.

3.2.5 Availability

The Integrated Logistics Support and Maintenance concept, in conjunction with the hardware, must ensure that operational availability shall meet one of the following criteria:

$Y \geq 90$, $X \geq 99.5$; or

$Y = 100$, $X \geq 97.5$; or

$Y \geq 80 + 5 \cdot (101.5-X)$, $97.5 < X < 99.5$

where Y is the operational availability in percent of benchmark workload capacity; and X is the percent of the time that Y is attained. This is accomplished for each deployable configuration, during a standard six month deployment. Recovery to 100% performance levels shall be achievable within the specified "mean time to repair" and "mean time to replace" requirements. There shall be a 95% confidence level that the actual performance of installed production systems shall meet or exceed these targets when operated by Navy personnel using the logistics support and maintenance procedures provided by the contractor.

For each system configuration, individual hardware units of a CVSMS system shall have a "mean time between failure" (MTBF) of 2,000 h, a maximum "mean time to repair" of 45 min. using system diagnostics, and a mean time to replace of 4 h. A "Unit" is defined in MIL-STD-280A as "An assembly or any combination of parts, subassemblies, and assemblies mounted together, normally capable of independent operation in a variety of situations." A failure is defined as any malfunction which cannot be repaired or adjusted by on site personnel in less than 5 min. MTBF is the average number of equipment power-on hours between two failures of a component. This MTBF requirement applies to all contractor supplied hardware.

3.2.6 Environmental Considerations

- Humidity: The CVSMS system shall withstand noncondensing humidity conditions of 5 to 95% while in the nonoperating mode, and of 10 to 90% in the operating mode.

- **Temperature:** The CVSMS system shall withstand ambient temperatures of 18-66°C while in the nonoperating mode and of 10-50°C while in the operating mode.
- **Cooling:** The CVSMS system shall be cooled by convection and radiation. A forced-air blower may be used if necessary.
- **Altitude:** The CVSMS system shall withstand pressure altitudes of 0-5,000 ft while operating, and of 0-40,000 ft when not operating.
- **Thermal Shock:** The CVSMS system shall withstand nonoperating shock at a rate of 16°C min.
- **Inclination:** The CVSMS system shall withstand operational cycling of ± 15° at a rate of up to 0.12 Hz. In addition, nonoperational inclination up to 45° shall not cause damage or prevent the system from performing normally when inclination is within operational limit
- **Mechanical Shock:** When normally installed and positioned, the CVSMS system shall withstand shock through the mounting points of up to 3 g's and be capable of returning to undegraded operation. This shock will not exceed a duration of 10 ms, and the time between consecutive shocks will not be less than 5 s. Further, the system shall not come loose or otherwise create a hazard to personnel or vital systems when operating under these conditions.
- **Vibration:** The CVSMS system shall withstand normal ship vibrations during operation, including catapult evolutions.
- **Airborne Acoustic Noise:** The CVSMS system shall not emit airborne acoustic noise greater than the speech interference level of 64 dBm average.
- **Interference:** The CVSMS system shall avoid interference with or from other electrical and electromagnetic systems.

3.2.7 Transportability

The packaging of the CVSMS components in their transport cases shall permit rapid and simple transport and set up in any designated ship location by minimally trained personnel.

3.3 DESIGN AND CONSTRUCTION

The CVSMS system shall conform with all the applicable requirements of MIL-E-5400 for design, construction, and workmanship, except as otherwise specified herein.

3.3.1 Materials, Processes, and Parts

In the selection of parts and materials, fulfillment of major design objectives shall be the prime consideration. In so doing, the following shall govern:

- Either microelectronic integrated circuits or large-scale integrated circuits are to be used for all arithmetic and logic functions.
- Nonrepairable subassemblies shall be used in accordance with MIL-STD-2084 and MIL-STD-E-5400.
- All microelectronic devices and parts shall be readily available, off-the-shelf, from at least two qualified sources. All second-source microelectronic devices and components shall be mechanically and electrically interchangeable.
- Circuits shall be designed to use a minimum of different materials, parts, subassemblies, cards, and modules.
- All parts and materials shall conform with applicable requirements of MIL-STD-5400, or better.

Approval for use of nonstandard parts and materials shall be obtained as outlined in MIL-E-5400. Microelectronic devices shall be approved as outlined in MIL-STD-965, except that approval as a nonstandard part shall not be required for devices which are:

- listed in MIL-STD-1562,
- available from at least two sources which are listed in the appropriate QPL of MIL-M-38510, and
- procured to the requirements of MIL-M-38510 from a qualified source.

When used, microelectronic modular assemblies shall meet the requirements of MIL-STD-965 and MIL-STD-883. Conformal coatings, encapsulants, and embedments of potting materials used with modular assemblies containing circuits and discrete parts shall be easily removable without damage to the assembly.

3.3.2 Electrical Requirements

- A 115V, ac, 60-Hz, ungrounded, single-phase electric power supply will be provided for the CVSMS system. Special attention is required in this area because the normal commercial practice of using a grounded neutral leg is not followed; all input power controls shall interrupt both sides of the ac service.
- Circuit Protection: Deployable ships are supplied with irregular power. The power supply design shall allow for adequate circuit protection against power fluctuations. Voltage regulation, transient protection, and noise filterings shall be provided for the CVSMS system.
- Interference Control: The generation of electromagnetic interference by the equipment and the vulnerability of the equipment to electro magnetic interference shall meet the requirements of MIL-STD-461, with Notice 3.

3.3.3 Interchangeability

In addition to the requirements of MIL-E-5400, all parts having the same part number shall be interchangeable with each other and with respect to installation and performance. Parts interchangeability shall be in accordance with MIL-I-8500.

3.3.4 Safety

The standard for safety (Underwriters Laboratories U.L. 478) shall apply to the CVSMS system configurations delivered under this contract.

3.3.5 Human Performance/Human Engineering

Human performance/human engineering design criteria for the CVSMS shall be in accordance with MIL-STD-1472. MIL-H-46855 shall be used as a guide for the contractor's program.

3.4 DOCUMENTATION

The documentation of the CVSMS system shall include at least 25 copies of each of the following:

- this specification,
- computer operator manuals - operation of all machines, operation of the system, and use of utility programs for operation,
- systems programming manuals - operating system, utilities, and programming aids,
- programming reference manuals - languages, command interpreter, utilities, messages, and other programming function manuals,
- user interface manuals - creation, modification and programming for applications in the user interface,
- hardware manuals - all equipment,
- training manuals and aids - as required to satisfy Section 3.6,
- configuration management plan,
- monthly configuration management status reports,
- configuration management system components descriptions,
- software configuration control library system,
- verification plan (format left to discretion of the contractor),
- program management plan,
- system installation manual,
- system test plan,
- system security plan,
- reliability program plan, and
- system development documentation, as described in DOD 4120.17M

3.5 LOGISTICS

Integrated logistics support (ILS) is a composite of all the support considerations necessary to assure the effective and economical support of a system for its life cycle. It is an integral part of all other aspects of system acquisition and operation. The objective of ILS is to ensure that accurate, timely, and adequate logistic support is delivered to the Fleet in a timely manner and at a reasonable cost over the system life. The contractor shall use his existing training concepts and materials, technical publications, repair facilities, repair parts concepts, and technical services personnel to tailor an ILS program to fit into the Navy operating environment for deployable systems.

3.5.1 Maintenance

The CVSMS maintenance concept integrates the technology and design of the new computer system to the existing Navy maintenance concept and structure used to support the Shipboard Navy ADP Programs (SNAP I and SNAP II). The maintenance concept for SNAP requires minimal component repair actions. Most system repairs are achieved through replacement of mechanical assemblies or electronic modules. Failures shall be located and confirmed by use of on-line diagnostic techniques and procedures as much as possible.

3.5.2 Supply

The contractor shall provide for spare parts support and associated depot level repair beginning with the delivery of the first production CVSMS system configuration. Spare parts support shall be planned by the contractor, based on historical failure rate data for the equipment proposed. Failure rates shall be developed using accepted industry standards for reliability computations. Failure rates shall be expressed as failures per million hours of operation.

The contractor shall recommend an initial allowance of repair parts for each deployable CVSMS configuration. The allowance shall be developed to achieve the system mean time to repair objectives, when used with system diagnostic capabilities by Navy crews using training and technical documentation provided by the contractor. The allowance list shall be adequate to support the CVSMS configuration in a deployed status for 6 months.

3.5.3 Facilities and Facility Equipment

The CVSMS system installation shall be accomplished at each of the fifteen designated deployable units and at the Shore Support Facility by a combined team of site, Navy support, and CVSMS contractor personnel. The Government portions of the team will prepare the site to receive the CVSMS equipment. The Government and CVSMS contractor will install the CVSMS equipment. The CVSMS contractor will check out the system, certify its readiness for operation, and train the site operators and maintenance personnel to the extent necessary to support satisfactory operation of the CVSMS hardware using the CVSMS software. The installation and training shall be completed within a 28-day "Technical Availability" for those sites aboard ship. The first week of availability will be devoted to site preparation by the Government portion of the team. The

final 3 weeks of the period will be utilized by the full team, including contractor personnel, for installation checkout, training, and readiness certification.

3.6 PERSONNEL AND TRAINING

3.6.1 Personnel

The CVSMS user community will include representatives at all levels of shipboard personnel - from the CO and XO, down to maintenance, repair, and administrative personnel. The operation of each individual system unit will be left to the user, with aide available from onboard data processing support personnel.

3.6.2 Training

The contractor shall develop a Training and Support Plan and provide training materials and services for at least:

- First Article Test Team Training for operations and for maintaining the CVSMS system so as to achieve First-Article testing and verification.
- Instructor and intermediate level maintenance technician theory and maintenance training.
- On-site training and support materials and services for all levels of system users, DS maintenance personnel, and DP support personnel. The contractor shall also provide an automated self-study training package, fully integrated within the CVSMS system. The self-study training package may be utilized as part of the contractor-furnished initial site training, but it must be capable of subsequent reutilization by the Navy for small group or individual refresher training without contractor instructor services being required.
- Specific training support materials and services shall be delivered in concert with hardware installation.

3.7 FUNCTIONAL AREA CHARACTERISTICS

The CVSMS system consists of:

- Human-Computer Interaction
- Applications

- Supporting System Software
- Supporting Hardware.

The functionality provided by CVSMS components is described in the following subsections.

3.7.1 CVSMS Human-Computer Interaction

The basic concepts of user interaction are menu selection, large network, rapid response, and active selections.

3.7.1.1 Menu Selection. The basic interface to the user is a Frame of information displayed in a window of a video terminal device (VDT). The Frame display should be simple enough to be easily and quickly assimilated. A self-explanatory Frame is displayed as Figure 2. The user's interaction with the computer is controlled by selection of one choice from among those available on a given frame. The user's act of making a selection is a simple unitary gesture (one keystroke or one mouse click). Room is provided for descriptive information on each frame, including short descriptions of each selection. This interface provides a simple technique for data access and is appropriate for the one-finger typist, the novice user, or the experienced computer user. The selections that are available from a given frame may include any of three types, which will be referred to as Options, Local Pads, and Global Pads. Generally, an Option is selected to retrieve more details within a hierarchical data structure, a Local Pad is selected to refer to related information in another hierarchy, and a Global Pad is selected to perform some other function, such as editing a frame.

3.7.1.2 User-Extensible, Large Network. The editor (selected by typing "e") can be used to alter any of the parts of the Frame (unless the frame is protected). New frames can be created, or new options or local pads can be created and/or linked to other frames. Very large collections of interrelated frames can be created by people who need not know any of the details of programming languages, the operating system, the data management system, or a conventional editor. The network of frames is large enough to accommodate all communication and knowledge-exchange required by the user within a single computer environment.

THIS TITLE LINE SUMMARIZES THE FRAME'S CONTENT
ZOGBRIEF6

THIS TEXT EXPANDS THE FRAME'S MAIN POINT OF INFORMATION. IT IS OFTEN OMITTED. THE OPTIONS BELOW CAN PROVIDE AN ENUMERATED EXPANSION.

1. THIS OPTION LEADS TO ANOTHER FRAME
2. OPTIONS OFTEN ARE LIKE SUBPOINTS IN AN OUTLINE
3. THE MINUS SIGN MEANS THIS OPTION HAS NO NEXT FRAME

L – THIS LOCAL PAD IS A CROSS-REFERENCE LINK

A – LOCAL PADS CAN ALSO EXECUTE ACTIONS

(THE SELECTIONS BELOW (GLOBAL PADS) ARE AVAILABLE ON EVERY FRAME)

EDIT HELP BACK NEXT PREV TOP GOTO SLED CAN RET UTIL DISP LOG OLD INFO WIN JUMP

Figure 2 - A Self-Explanatory ZOG Frame

Frames are grouped naturally together into hierarchical units, referred to as Subnet's, as they are built.

3.7.1.3 Rapid Response. The time from selection of a new Frame to display of that Frame is less than 1 s, independent of the size of the database. Rapid response is important to enable the user to move at his own pace and not become distracted while waiting for the computer. The limiting factor to accessing information is then human thinking time rather than computer response time.

3.7.1.4 Active Selections. A mechanism exits for implementing Actions which can move the user through the database, control communications, modify frames, produce hard-copy output, or invoke an Agent (a program which can act on a portion of the database). Actions may be initiated by typing a series of commands (in the form of a textual string), or they may be attached to a frame or menu selection and automatically invoked whenever the frame is visited or the selection chosen.

3.7.1.5 Additional Characteristics. The CVSMS functionality is not completely defined by the preceding concepts. Additional characteristics that are necessary to describe the technique are now described.

3.7.1.5.1 Structure of a Frame - It is necessary to understand the parts of a Frame and how they are put together. Every frame is divided into four substructures called Items: the Frame Identification, Frame Title, Frame Text, and Selections. Selections, which represent choices of what to do next, are of three types: Options, Local Pads, and Global Pads. A particular frame may not have all of these types. But every Frame has a Frame Identification. Figure 3 highlights the conventional physical location of these items on the VDT.

The frame identification (FRAMEID) is a label which uniquely identifies every frame in a database of subnets. It is composed of two parts; the name of the subnet, and a frame number which is unique in that subnet.

The frame title (TITLE) is usually found on the top line of a frame on the left side. Unless it is specifically altered, it contains the text of the Option that led to the Frame at the time the frame was created. This duplication of

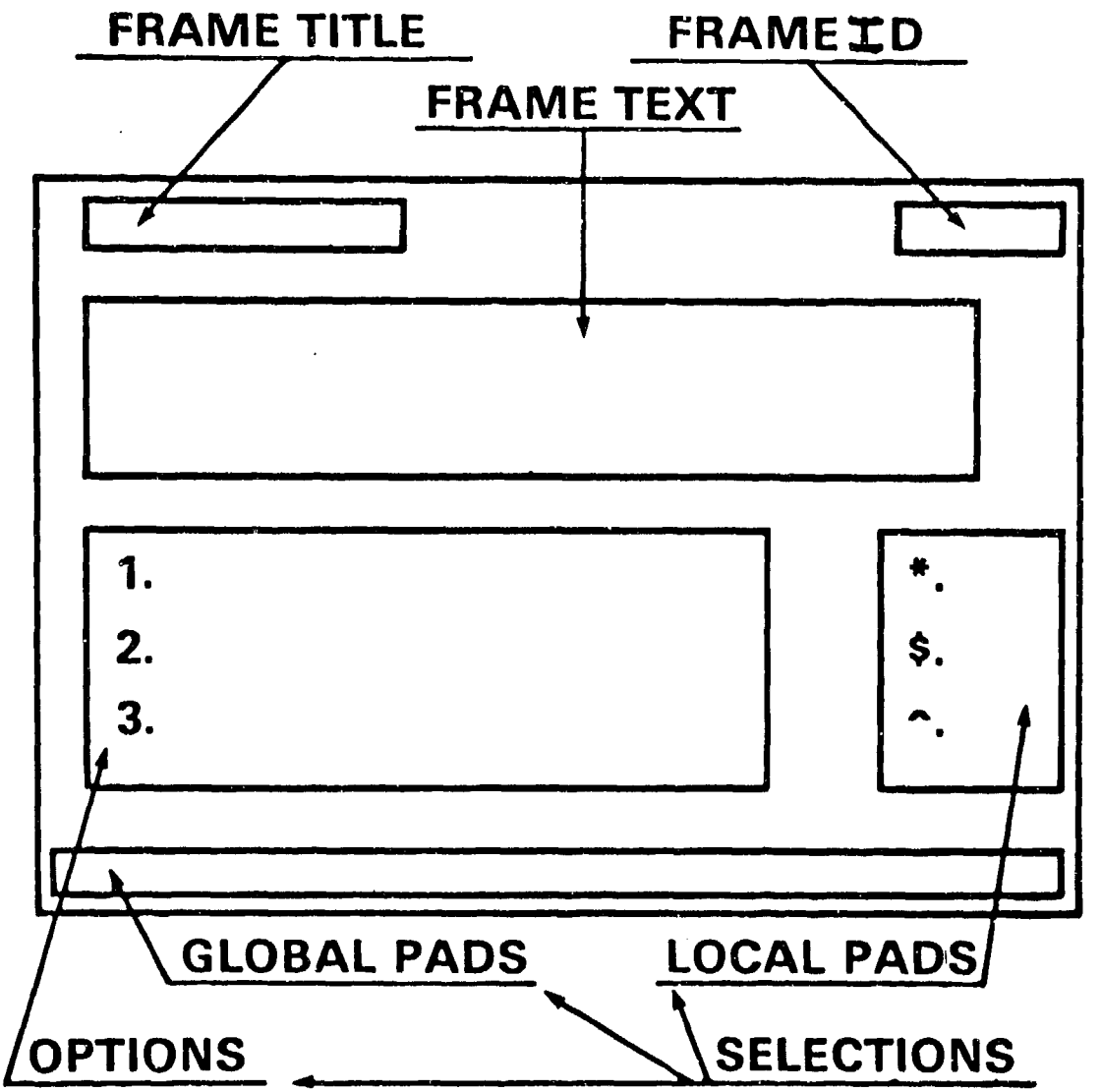

Figure 3 - Conventional Locations of ZOG Items on a Frame

information is designed to help the user maintain the context of where the frame is in a subnet and where the subnet is in the database.

Most frames contain explanatory information in addition to the frame title. This is entered in the form of Frame TEXT. It usually begins two lines below the Frame Title.

Selections are the pointers between frames in the database of Frames. The user navigates through the database by making selections, via the keyboard or mouse, to which the system responds by displaying the next Frame. Options consist of a selection character and Option text. Options usually appear as numbered selections, the beginning characters of which are in vertical alignment down the left side of a frame. The first three characters of the Option text are normally the selection character followed by a period and then a space. The rest of the Option text is usually a subpoint of the subject stated in the frame's title. Selection of an Option leads to a Frame containing additional detail which further describes the Option (if additional detail exists).

Local Pads are also selections which lead to other Frames. They look and behave exactly like Options. They usually have upper case letters as their selection character. The difference between Local Pads and Options is not strictly defined. They are usually easy to identify, because by convention Local Pads are placed in the lower right-hand corner of the frame and Options in the upper left-hand corner. Also by convention, Local Pads point to Frames which do not fit comfortably into a tree structure formed by the options and the associated frames that provide detail breakdowns of the Options. In other words, Local Pads usually point to cross references, examples, or some supplementary material that is in some way tangential to the main topic of the Frame. Often there is a Local Pad which appears on every Frame in a subnet, and always serves the same function. Also, there are by convention special Local Pads that are available to every frame in a subnet, such as the "OLD" Pad which is used to point to the previous version of a Frame that has been changed at some time in the past.

Global Pads are a third type of selection and are found on the bottom line of the Frame. They are selected by typing the first letter (always a lower case letter) of the desired selection. A standard set of Global Pads is maintained, which occurs on almost all frames, although the standard set can be changed for a particular frame or for a particular subnet. Global Pads are called selections

because they provide more choices for the user, that is, more ways to move from frame to frame.

Some Frames have no Options or Local Pads. This often happens when a frame is at the bottom of a tree and gives a lot of information rather than presenting more choices. If an Option or Local Pad has been created but the Frame to which it points is null or has not been created yet, then the character following the first character in the Option or Local Pad text is replaced by a hyphen.

3.7.1.5.2 Schemas - The CVSMS application designers often create standard schema frames that are meant to be copied because they contain standard formats and items. By default, the zero-numbered frame of a subnet is a schema frame that is used, again by default, as a beginning model for the creation of new frames in a subnet. Conventional usage of CVSMS utilizes this standard frame format property within a subnet maximally to provide the user an understanding of the usage of a particular subnet in an application.

3.7.1.5.3 Actions - The selection in CVSMS can execute programs and take ACTIONs other than just search and retrieval of the network. Thus CVSMS is an active system rather than just a data retrieval system. Actions can be attached to frame selections or to frame entry or frame departure. Actions are specified by means of a communications language which allows the user and the frame builder to maintain control over the interactions between the user and the various parts of the system. The communications language provides six basic facilities: network positioning, communications control, frame modification, hard-copy output, videodisc control, and activating agents.

3.7.1.5.4 Agents - The most powerful action is one which executes an arbitrary specified program. Application builders can build programs particular to their application and attach them to the database at appropriate points in the application subnet via this Action command. These programs are called Agents since they act as an agent for the user in performing some required function. The ability to create Agents and attach them provides the CVSMS users with a convenient mechanism for extending the functionality of CVSMS. Agents are programs that are specially user designed and built to execute under CVSMS control.

3.7.1.5.4.1 Environments

Environments provide a friendly, uniform, and complete interface between CVSMS agents and the users invoking those agents. Agents require various parameters or arguments to be specified for a particular execution (the number of parameters may be zero). When an Agent is executed, a specific environment is searched for all required arguments. Each environment is defined by a collection of agent parameters called slots and exists as a set of CVSMS frames.

3.7.1.5.4.2 Slots and the Slot Editor

The environment interface provides both a complete means for an Agent to obtain its needed arguments and a simple editor (slot editor) to permit the user to alter the slot values of an environment frame. Each slot is contained on the environment frame as an option linked to a slot frame which lists the attributes of the slot (again as Actions). The slot editor can only be used to modify Options that have been specially identified as slots. It is a specialized editor that allows the user to quickly, easily, and accurately edit specific fields on often used frames. It is designed to be extremely easy to use and requires only a few minutes of on-hands experience for the user to become comfortable with its use. The user is not required to know how to operate the frame editor or even to understand the nuances of the structure of a Frame.

Any Option on a Frame can be altered to accept the slot editor, but as a rule the Option should be one that will require regular modification with a consistent type of entry. In addition to using slots and the slot editor for environment frames, this capability is also used to simplify filling in of task frame parameter values in the SORM and P&E applications.

3.7.1.5.5 Frame Editor - Each Option or Local Pad has associated with it a NEXT-FRAME attribute which points to another Frame within the database. The Frame pointed to is processed and displayed following selection of an Option or Local Pad. If the user selects an Option or Local Pad with a null value in the Next-Frame attribute, CVSMS will, at the user's option, create a new Frame linked to that selection. The CVSMS fills in the frame number of this new Frame in the Next-Frame attribute of the selection the user made. The CVSMS then places the user at the new Frame, in the frame editor.

It is a display editor with a large set of commands for editing the textual content of a frame, rearranging the positions of items on a frame, and editing the nondisplayed information such as Next-Frame links. Most editor commands are single characters. The Frame being edited is always displayed. Edit commands can be entered via the keyboard, with positioning and single selection capabilities available via the mouse also. Edit commands entered via the keyboard are typed (but not echoed), and the results of an edit operation appear as changes to the displayed Frame.

Another way for the user to enter edit is through the EDIT Global Pad which appears on most frames. Within the editor there are several modes: COMMAND, in which characters are interpreted as commands and command arguments; INSERT, in which characters are inserted into the text at the current location; POSITION-ITEM; and HELP mode. The EXIT command returns the user to normal selection mode.

3.7.1.5.6 User Search Mechanism - The FIND Global Pad is used to access the environment frame for the agent used for finding frames which meet certain conditions. Other agents can be written to search and process frames, but FIND is the only required general purpose search mechanism available to the user, other than examining every frame, for determining what is happening in a subnet. The values listed in the slots on the find environment frame, in effect, tailor a specific execution of the find agent to the user's specification. All of the criteria have default responses. Slots included on the find environment frame are: string to search for, date frame modified, time frame modified, frame modified by whom, search frame-title/whole-frame and subnet to search. Once all the criteria have been filled in, the find agent is run by selection of one of the Local Pads. All frames meeting the criteria are placed on a FOUND LIST of Next-Frame pointers, which is accessible through other Local Pads on the find environment frame.

3.7.1.5.7 Utility Agents - The following list of utility functions is also required:

- frame creation, deletion, and moving
- subnet creation, deletion, and renaming
- database indexing by subnet
- copying a subnet

- setting frame protection
- outputting pictureforms of frames
- reading and writing external format of subnets into files
- statistics and log files

These utility agents, as well as the other CVSMS components of the CVSMS system, will initially be written in the Ada programming language.

3.7.1.5.8 Statistics Gathering - The CVSMS will be instrumented for gathering various kinds of statistical data about usage. Dynamic statistics are gathered while a user is interacting with the system. They record and summarize all user actions. These statistics are gathered and stored in frame format when a user exits the system. In addition, fatal error conditions producing a system crash will be written to a system file whenever possible.

3.7.2 Applications

Two application components have been fully defined, SORM and P&E. Other components must be supported, but have been less stringently defined, especially Electronic Mail.

3.7.2.1 SORM. By regulation, all Navy ships must have a Ship's Organization and Regulations Manual (SORM). The SORM is used as the central ship's document containing prevailing instructions for all general functions. Most SORMs are created by members of the commissioning crew using materials available from SORMs of similar vessels, updated for the current ship.

The original management application component defined for the CVSMS system is to produce an automated SORM in the database so that its contents can be accessed on-line. The intended use of the CVSMS-generated SORM is to facilitate creation, revision, and access to an accurate SORM document. Additionally, by having the SORM on the system updated, hard copies of the SORM can be easily generated by means of the document printing program. Also, the SORM will provide a central organizing authority for other subnets and their development or revision. The estimated size for the SORM is 30,000 frames per ship.

The SORM consists of tasks, which are hierarchically organized into task subnets; the ship's organization structure containing billets, departments,

committees, etc.; and cross linkages between tasks and organizational responsibilities. Standard schemas will be developed for tasks and for billets. Additional Frames will contain explanatory information and references.

3.7.2.2 Planning, Implementation, and Evaluation. The function of planning, implementing, and evaluating (P&E) is a continuous activity for shipboard management personnel. Ship's evolutions are constantly being scheduled for both the immediate and distant future. The second management application component of the CVSMS system is the P&E component to provide support for the planning, monitoring, and evaluation activities of management personnel that are necessary for conducting ship's evolutions.

Plans will be built as integrated subnets, which will be updated and modified continually as each plan is extended and changed. Guidance in implementing plans will be provided both by on-line access to the plan and by hard-copy versions. The planning horizon ranges are from 1 day up to 6 months, and include both one-time and recurrent plans. Several ways to examine and manipulate plans are envisioned. They can be examined from different perspectives, e.g., all tasks in a given time interval, all subtasks necessary for a task, all tasks to be accomplished by a person, or all of a type of resource needed for all tasks. Completion status is to be optionally propagated from specific frames to summarizing frames.

Maintaining the SORM and constructing plans are independent management functions for a carrier. However, the SORM will be used to contain generic plans to carry out those tasks on the ship that are recurrent or sufficiently important to rate prior analysis. Then when dynamic planning encounters a task covered by a generic plan already in the SORM, the generic plan can be incorporated into the plan. The final plan might require adaptation to local circumstances, but the generic plan can still provide the starting point. The consequences of this for CVSMS are twofold. First, there must be the capability to find relevant parts of the SORM and instantiate them into a plan. Second, the structure adopted for the SORM itself must include generic plans for accomplishing well-defined tasks.

3.7.2.3 Electronic Mail. The CVSMS will support a single view cross-dialog mail system which contains mail frames whose information content grows over time as the sender and receiver interact.

3.7.3 Supporting System Software

3.7.3.1 Operating System. The operating system environment and how easily it supports CVSMS requirements is clearly very important to the ease of installing CVSMS, and possibly important to the effectiveness of CVSMS.

The kernel of the operating system shall provide an execution environment including support of interprocess message communication (IPC), virtual memory management, and process management.

3.7.3.2 File System. The functional, performance, and reliability constants for the file system are:

- CVSMS shall be able to store and manipulate files that are larger than the secondary storage available on an individual CVSMS machine. Access to these files should not require mechanisms different from those used to access smaller files.
- CVSMS shall be able to support very sparse files compactly. Sparse files include those that are copies of a sparsely populated, large, virtual address space.
- CVSMS shall support the sharing of files between different users, and supply accessing techniques that control the method sharing.

3.7.3.3 Graphics and Environments. The graphics package supplies the abstractions necessary to allow the orderly use of the user input/output (I/O) devices (the screen, keyboard, and the pointing device) by independent programs.

Environment is the user interface package which supplies (a) the means of invoking programs and (b) the mechanisms for providing them with the environment they need during execution. In particular it provides programs with parameters, switches and commands, and means of presenting information on the screen.

3.7.3.4 Programing Language Support. Ada will be the programming language used to implement CVSMS and CVSMS agents.

3.7.3.5 Editor. A general text file editor is required for creation, modification, and deletion of system files. A good general editor is required which allows multiple windows, contains a help facility, and also allows the use of the mouse.

3.7.3.6 Document Preparation. A document preparation package is needed which controls words, lines, pages, spacing, headings, footings, footnotes, numbering, tables of contents, indexes, and more. It has a database of document format definitions, which tell it the rules for formatting a document in a particular style.

3.7.4 Supporting Hardware

3.7.4.1 Basic Architecture. The basic system architecture will be a linked network of personal work stations, each of which is a powerful computer in its own right. Two of the most important benefits of this distributed personal computer approach are: (1) rapid response to most user requests can be guaranteed since there is essentially no competition for processing power; and (2) the system can be grown incrementally by simply adding new work stations to the network.

3.7.4.2 Number of Work Stations. In order to estimate how many work stations are required for each CV and CVN, the following assumptions were made and the average waiting time was determined using queing theory calculations:

- Each user will require two sessions each day of work station utilization
- Each session will average 45 minutes
- Each work station will be available for use by departmental personnel only
- Each work station will be available to users for random access for 12 hours per day

- Each user will access a workstation once in the first 6 hours of availability and once in the second 6 hours of availability.

Table 2 shows the allocation of work stations determined by holding the average waiting time to 10 minutes or less:

TABLE 2 - LOCATION AND NUMBER OF WORK STATIONS REQUIRED

DEPARTMENT	DIVISIONS	USERS	WORK STATION
Administrative	5	9	2
AIMD	4	10	3
Air	5	8	2
Communications	2	8	2
Deck	5	7	2
Dental	1	3	1
Engineering	5	13	3
Management	1	4	2
Medical	1	6	2
Navigation	2	3	1
Operations	8	17	4
Reactor	5	10	3
Safety	1	2	1
Supply	8	10	3
Training	2	8	2
Weapons	6	12	3
Commanding Officer	-	1	1
Executive Officer	-	1	1
Conference Room	-	-	1
Net Maintenance (Mgmt)	-	-	2
Air Wing	-	-	1
Total Number of Work Stations			42

3.7.4.3 CPU Processing and Memory Requirments. A powerful processor of at least 1 MIP (million instructions per second) is needed. This requirement is dictated by the need for rapid response to the user's requests.

3.7.4.3.1 Main Memory - Main memory will be at least 1 megabyte.

3.7.4.3.2 Virtual Memory - A large virtual address space is required; at least two to the twentieth power. This is needed to accommodate the sometimes very large application programs expected and, more particularly, buffers for accessing portions of the database.

3.7.4.4 Secondary Storage. A large fast, local disc of at least 20 megabytes is needed. A central storage disc facility is envisioned of about 600 megabytes for archival backup.

3.7.4.5 Communictions and Networking. The distributed personal computer paradigm is incomplete without the provision of a high-speed network connecting the individual work stations. The network must be fast enough so that access to remotely stored data is nearly transparent; i.e., accessing the disc of a remote work station is almost as fast as accessing the local disc. A speed of at least 10 megabits/s is required.

3.7.4.6 Input Requirements.

3.7.4.6.1 Keyboard - The keyboard will be detachable from the display unit and need not have a separate function key pad or numeric key pad.

3.7.4.6.2 Pointing Device - A pointing device is needed to allow simple, direct selection of textual and graphical items on display. This is particularly important for users without prior computer experience.

3.7.4.7 Output Requirements.

3.7.4.7.1 Screen Processing - A high resolution display of at least 800 by 1000 points is required. This is necessary to display a sufficient quantity of information (often for several operating contexts simultaneously) to avoid short-term memory strain for the user.

A bit-mapped raster scan display is needed, with the display memory addressable by the processor. This is necessary to provide rapid, selective updating of the display as feedback to user operations.

3.7.4.7.2 Printing - A high-quality graphics page printer is required to produce specially formated documents such as the SORM. Print speed should be at least 6 pages per minute. Local work station printers are required for some of the work stations.

3.7.4.7.3. Videodisc and Display - A videodisc reader and video display unit will be operated under control of CVSMS.

3.7.5 Reliability

All of the equipment will be operable on board each CV/CVN under conditions normally expected for a carrier underway. The equipment should be operational at least 95% of the time, under the assumption that full board swap-outs will be performed by ship's company and that adequate spares are made available on board the VINSON using estimates calculated in conjunction with the contractor.

3.8 PRECEDENCE

The order of precedence in evaluating compliance with this specification will be:

1. Compliance with Mandatory features
2. Completeness of Optional features
3. Ease of System Learning and Usage
4. System Reliability
5. Maintainability (esp. Integrated Logistics Support Program)
6. System Expandability (Capacity and Functionality)
7. Physical Compactnes

4. QUALITY-ASSURANCE PROVISIONS

4.1 GENERAL

The underlying philosophy of CVSMS testing is to provide a convincing demonstration of the completeness and reliability of the CVSMS system. Testing and quality assurance are a complement to the formal verification aspects of the system.

The CVSMS shall be subject to periodical reviews by the Government. The contractor shall produce test plans and conduct Category I and Category II testing.

4.1.1 Responsibility for Tests

The development contractor shall conduct all CVSMS functional testing from Government-approved test plans and procedures. Test reports shall be prepared for all formal tests and submitted to the Government for approval. The Government may elect to witness selected tests. All testing shall utilize Government-approved quality-assurance procedures.

The Government will be responsible for conducting the security testing necessary for CVSMS certification and accreditation. In addition, test scenarios will be developed to provide assurance that the security measures are working properly. These tests should be run on a regular basis during CVSMS operation.

4.2 QUALITY-CONFORMANCE INSPECTIONS

The Category I and II tests and the technical reviews shall be the mechanisms by which compliance with the requirements of Section 3 is determined.

5. PREPARATION FOR DELIVERY

This section is not applicable to this specification.

6. NOTES

This section is not applicable to this specification.

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